"The marine world may be degrading faster than our terrestrial one as pollutants pour into it from the land and sky, and stocks of many species decline from overfishing."

National Park System Advisory Board, *Rethinking the National Parks for the 21st Century*, 2001

Marine and Coastal Resource Preservation

NPS PHOTO BY DAN RICHARDS

As a result of fishing, reefs dominated by purple sea urchins, brittle stars, and sea cucumbers have replaced 80% of the kelp forests in Channel Islands National Park since the park was established in 1980. Twenty-four years of marine monitoring revealed these and other alarming changes in ecosystem health and helped secure the designation of 10 marine reserves in or near the park in 2002.

Although they cover approximately 70% of the planet, oceans are one of the least studied environments on Earth. For centuries, the relative inaccessibility of the seas has contributed to our ignorance of their vast resources. But science is progressively illuminating what was once unknowable and hard to imagine—that the oceans are fragile and must be conserved if they are to thrive and continue to sustain, enlighten, and inspire us. Knowledge is vital in the conservation efforts now unfolding to preserve marine ecosystems, and the National Park Service has a leading role to play in them. In 1998 an executive order, followed by urging of the National Park System Advisory Board, boosted efforts to study and protect coral reefs and marine life in the national parks. As a result, coral reef parks are collaborating more and are either beginning to monitor reefs or refining their monitoring protocols. Partners continue to pioneer ways to gather management information through logistically difficult studies. Especially promising is the designation of fully protected marine reserves in Channel Islands and Dry Tortugas National Parks over the past two years, which are expected to help replenish sea life far beyond the boundaries of these national parks. Several of these themes are explored in the following articles about marine and coastal resource protection in 2002.

Science, partnerships, and persistence begin to restore lost marine ecosystems and fisheries at Channel Islands National Park

by Gary E. Davis

DURING THE 1980S AND 1990S, FISHING dramatically altered marine ecosystems in Channel Islands National Park, California, reversing nearly 30 years of National Park Service stewardship. Alarmed by more than two decades of scientific data showing declines in ocean vital signs in the park, the National Park Service and some experienced recreational fishers requested that the California Fish and Game Commission designate a network of reserves in the park. The purposes of the reserves were to rebuild populations of sea life depleted by fishing, to restore ecosystem integrity, and to sustain fisheries in the future. Four years of community negotiations and public hearings followed the request, culminating in 2002 in a commission decision to establish 10 marine reserves in and near the park (nine in park waters and one within a mile of the park). State regulations, scheduled to take effect in April 2003, create a network of 1,200- to 20,000-acre reserves, totaling nearly 75,000 acres, that will replenish depleted populations and preserve marine ecosystems for exploration, inspiration, and education.

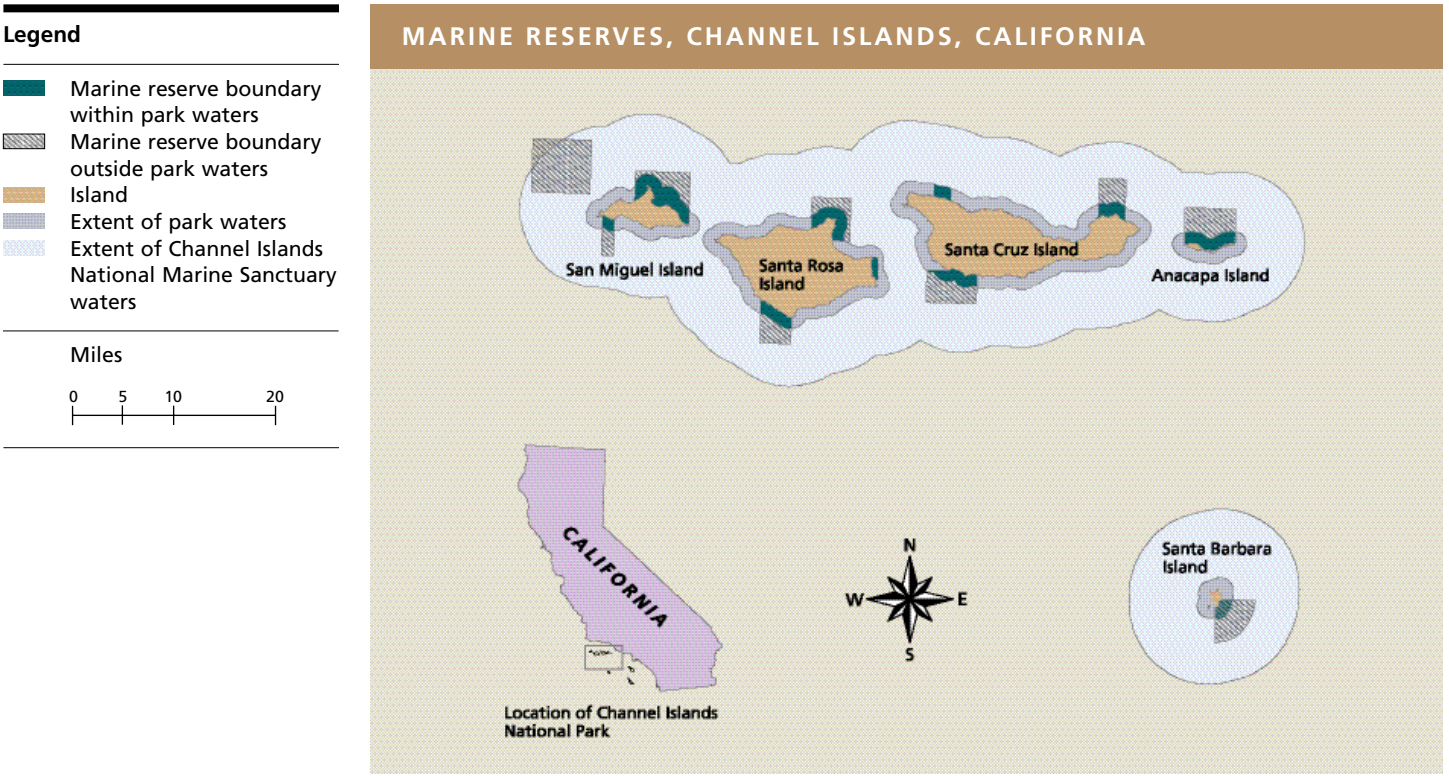
"This generation must … protect the integrity and resilience of ocean ecosystems by creating networks of fully protected marine reserves."

National Park Service stewardship of submerged resources at the Channel Islands began in 1949 with Channel Islands National Monument. Concern over declining populations of sea life led the National Park Service to curtail fishing in half of the monument in the 1960s. The number and size of lobster, abalone, and fish in the protected zones of the monument rapidly increased. When fished populations along the mainland coast and at other nearby islands began to decline sharply in the 1970s, a fisherman complained to the State of California that the ban prevented him from taking state-owned lobster. In 1978 the U.S. Supreme Court affirmed that California indeed owned the lobster in the monument by virtue of the 1953 Submerged Lands Act. The Court's decision eliminated 15 years of NPS protection, and fishing resumed under state control throughout the monument. Only a 37-acre portion of the Anacapa Island Ecological Reserve remained protected from fishing.

The California Channel Islands and surrounding waters have been recognized as special places by state designations as ecological reserve, nature reserve, area of special biological significance, and research natural area, and by federal designations as national park, national marine sanctuary, and biosphere reserve. Partnerships have been an essential part of conservation in this region for a long time. Congress created Channel Islands National Park in 1980 by expanding Channel Islands National Monument. The expansion explicitly added 119,000 acres of submerged lands and waters. This act ushered in a new era of state and federal cooperation at the islands. The National Park Service cooperated with the State of California and the U.S. Department of Commerce to implement a scientifically rigorous ecological monitoring program to measure changes in the health of the new park's island and marine ecosystems. More than 400 scientists from state and federal agencies and universities have helped to monitor and assess the health of kelp forests, rocky intertidal communities, beaches and lagoons, seabird colonies, and pinniped rookeries in the park over the past 24 years.

Monitoring revealed alarming changes in ecosystem health caused by fishing. For example, many species taken by fishing, such as pink abalone *(Haliotus corrugata)* and red sea urchin *(Strongylocentrotus franciscanus)*, declined rapidly, whereas species not taken fluctuated normally with environmental conditions. Elsewhere, the only place where fished species persisted for a time was the protected portion of the Anacapa Island Ecological Reserve. Kelp, rockfish, abalone, and red sea urchin populations declined drastically. California closed fisheries or severely restricted them in the 1990s to prevent extinctions and encourage population recovery. White abalone *(Haliotis sorenseni)* was listed as the nation's first endangered marine invertebrate, a species whose center of distribution had been the Channel Islands.

The findings also indicated that fishing removed the large predators (such as California sheephead, rockfishes, and lobster) and competitors (such as red sea urchin and abalone) needed to hold hordes of small purple sea urchins *(Strongylocentrotus purpuratus)*, brittle



A new network of 10 fully protected marine reserves in Channel Islands National Park and Channel Islands National Marine Sanctuary will reverse a 20-year decline in kelp forest productivity and biodiversity and help sustain local fisheries.

stars *(Ophiothrix)*, and sea cucumbers *(Cucumaria)* in check. Unconstrained, these species overgrazed reefs and kelp forests, excluded other species, and prevented young kelp plants from settling. Starvation and disease now control these species, resulting in wild boom-and-bust cycles.

"To restore and sustain ecosystems and to support fisheries, the latest understanding of marine species and ecosystems must be applied to the development of conservation strategies that are based on ecosystems rather than on individual species."

Monitoring also revealed that marine systems were much less resilient to natural disturbances after years of fishing. Storms associated with major El Niño events opened holes in kelp forest canopies. At most sites the canopy recovered a few years after storms, but after each event, purple sea urchins and brittle stars overran a few more areas. By 1999 nearly 80% of the kelp forest in the park was gone. Without kelp as food and shelter, depleted abalone and red sea urchin populations could not recover. In the "urchin barrens," areas overrun with purple urchins and brittle stars, fewer than 200 of the 1,000 species found in healthy kelp forests remained.

In addition, persistent organic compounds, such as DDT and PCBs, contaminate marine food webs, stressing fish and wildlife. The relative effects of pollution and fishing were revealed by comparing populations in areas affected by both fishing and pollution with populations in the protected area in the reserve. In the reserve, which was bathed in polluted water but free of fishing, kelp forests remained intact and large predators survived and kept other species in check. In other words, the reserve's kelp forests were resilient. They recovered quickly after storms and El Niño events, providing a thousand species with food and shelter. From these observations it was clear that fishing impaired the park's balanced, healthy ecosystem.

Monitoring vital signs of kelp forests in the park and recent advances in ecology revealed fatal flaws in conservation strategies. In the past, fishery scientists thought that the high potential reproductive capacity of older, mature fish was surplus to the needs of the species. For this reason managers believed that fisheries could be sustained by harvesting all the big fish and leaving only young fish to reproduce. Today it is clear that many species need the huge reproductive capacity of old fish to exploit opportunities for population gains provided by rare, extreme environmental events and to overcome predators and competitors. This need has become more evident as technology has advanced.

"State regulations … create a network of … reserves … that will replenish depleted populations and preserve marine ecosystems for exploration, inspiration, and education."

Although it was unknown in the past, remote and isolated patches of habitat at the islands provided refuge for old fish, which sustained fishing elsewhere. Modern technology, including fast boats with electronic fish finders and satellite navigation, eliminated these important havens by giving people access to even the most remote reefs and underwater canyons where remnant populations of large, old fish survived.

Research has shed new light on the complex functioning of marine ecosystems. Interactions among species are powerful forces that bind components of ecosystems together, but fishing removes selected species and dissolves those bonds. Fishing caused unintended consequences that cascaded through the park for decades and reduced productivity and biodiversity. To restore and sustain ecosystems and to support fisheries, the latest understanding of marine species and ecosystems must be applied to the development of conservation strategies that are based on ecosystems rather than on individual species.

To ensure that the people who follow us have opportunities to enjoy the sea's bounty—not only the wealth of food it provides but also its enduring beauty and inspiration—this generation must explicitly protect the integrity and resilience of ocean ecosystems by creating networks of fully protected marine reserves. Only in this way can we restore the fishing-weakened ecological interactions upon which resilient marine ecosystems depend, reestablish the lost reproductive capacity of depleted species, and provide insurance against human ignorance and arrogance. The new reserve network in Channel Islands National Park is a good beginning. ■

gary_davis@nps.gov
Visiting Chief Scientist, Ocean Programs,
Washington, D.C.

NPS PHOTO BY DAN RICHARDS

Giant kelp can grow 2 feet a day and forms towering forests more than 100 feet tall that harbor nearly 1,000 species of fish, invertebrates, and algae on rocky reefs in the cool, clear water around the California Channel Islands. The new network of 10 fully protected marine reserves in the national park and Channel Islands National Marine Sanctuary will reverse a 20-year decline in kelp forest productivity and biodiversity and help sustain local fisheries.

Partners plan for fishery's future in Biscayne National Park

by Todd Kellison and Rick Clark

"In tandem with long-term monitoring data … these studies suggested that fishery resources were in need of prompt and diligent management efforts."

LOCATED ON THE SOUTHEAST COAST OF FLORIDA, Biscayne National Park is the largest marine park in the National Park System, with 95% of its 173,000 acres covered by water. The park's diverse marine habitats include expansive coral reefs, seagrass meadows, and mangrove fringes that support productive fish and invertebrate communities. Like many coastal systems worldwide, the waters encompassed by the park have been subjected to the impacts of human influence, including population growth and related recreational and commercial fishing pressure.

Concerns about the condition of Biscayne's fishery resources became apparent in 2001, when a "Site Characterization" report concluded that approximately 70% of targeted species were overfished and that the number and size of most of the key targeted species appeared critically low within the recreational fishery. It also stated that exceptionally high and sustained exploitation pressures seem to have precipitated "serial overfishing" of key fishery resources, where depletion of a targeted species leads to the targeting and subsequent depletion of other species. Preliminary results from a fish and habitat census conducted by Drs. Jerry Ault (University of Miami) and Jim Bohnsack (National Oceanic and Atmospheric Administration and National Marine Fisheries Service) in May 2002 reinforced these findings, indicating that the size of reef fishes such as groupers and snappers was smaller in Biscayne than in areas characterized by lower fishing pressure. Ault said, "It took me … 24 dives in Biscayne National Park before I saw my first legal-sized fish, either snapper, grouper, or grunt." In tandem with long-term monitoring data at the park, these studies suggested that fishery resources were in need of prompt and diligent management efforts.

Given the park's mandate to conserve its resources for future generations, Biscayne is in the process of developing a fishery management plan to improve its long-term ability to manage and conserve fishery resources. The plan is the first of its kind in the National Park Service to be based on quantifiable desired future conditions (i.e., specific conditions to be met regarding size and abundance of fishery populations, issues related to catching nontarget species, fishing gear impacts on essential fishery habitats, and visitor experience), and will include a range of management alternatives that, when initiated in 2003, will directly contribute to the long-term protection and perpetuation of Biscayne's marine resources.

Critical to the success of the plan's development and future implementation have been the inclusion of public input, the establishment of a groundbreaking memorandum of understanding with the Florida Fish and Wildlife Conservation Commission, and the development of partnerships with the National Marine Fisheries Service and the University of Miami. In concert with the National Park Service, these partners share an interest in contributing to and supporting interagency and regional strategies to manage stocks of fish as a biological unit, transcending state and federal jurisdictional boundaries. This approach recognizes that measures to end overfishing and to rebuild stocks are most effective when implemented over the range of the biological stock and not limited to jurisdictional boundaries. As such, the cooperative approach underlying the development and implementation of the fishery management plan provides an excellent protocol to develop strategies for responsible management and conservation of fishery and other consumptive resources within the National Park System. ■

NPS PHOTO BY TODD KELLISON

Scientific surveys of key reef species such as grouper (right), snapper, and grunts indicate that the abundance and size of these species have declined because of increasing fishing pressure. With the support of state, federal, and university partners, the park is developing a fishery management plan to address overfishing and rebuild fish stocks.

todd_kellison@nps.gov
Fishery Biologist, Biscayne National Park, Florida

rick_clark@nps.gov
Chief of Resource Management, Biscayne National Park, Florida

Protecting surf in the national parks

by Rebecca Beavers and Adam Stein

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Surfers congregate at the end of a seawall at the Sandy Hook, New Jersey, unit of Gateway National Recreation Area. A recreational resource, the focused wave energy threatens to erode the shoreline and park access road. Through careful planning the National Park Service protected park infrastructure in 2002 without adversely affecting surfing.

IN MANY REGIONAL SURFING CIRCLES, NATIONAL parks are synonymous with excellent surfing. Cape Hatteras, Cape Canaveral, and Gulf Islands National Seashores have abundant opportunities that draw thousands of surfers each year. Ocean Beach in Golden Gate National Recreation Area and Malibu in Santa Monica Mountains National Recreation Area are two of the numerous West Coast locations visited by many of California's 600,000 surfers. As a recreational resource, surf is of primary importance to surfers and surf-related visitors. But it also influences the aesthetic experience of many other park visitors and in some cases is culturally significant. Unfortunately the locations, characteristics, and threats to surfing areas in the national parks have not been well documented. The National Park Service has begun to gather information on this valuable natural asset in order to enhance its protection.

In 2002 the NPS Geoscientists-in-the-Parks program and the Surfrider Foundation jointly funded an inventory of surfing resources in the National Park System. This project included surfing locales or breaks from the Great Lakes to American Samoa and identified 85 surfing spots in 25 separate national park units, with 28 units still under study. The inventory documented the type, season, and level of use of each area, along with management issues that could affect the surf. It also identified surfing resources with major cultural significance or especially high levels of use. Many parks were unfamiliar with their surf breaks and will benefit from the findings, such as digital data, which will be reported to managers in 2003. The information will be easily applicable to park management issues because the data will also be made available in a Geographic Information Systems (GIS) database.

A recent case study at Sandy Hook in Gateway National Recreation Area illustrates how one park dealt effectively with a management problem involving a prized surfing resource. The surf in "Big Cove" is the result of a lengthy New Jersey seawall that extends into the southern boundary of the park, producing waves that are enjoyed by surfers. However, this focused wave energy threatens to erode the shoreline along the only road accessing northern portions of the park and other infrastructure. In developing plans to protect this critical area, park staff reviewed shoreline monitoring data on the erosion problem and discussed management options with surfing organizations. The combination of open communication and scientific information enabled the park to make an informed decision that benefited all parties. In 2002 the park replenished beach sand to protect park infrastructure, but in small enough quantities and at a distance far enough away from the surf break to ensure its preservation. Russ Wilson, superintendent of the Sandy Hook unit, summed up the positive outcome. "Through an open dialogue … we have made several changes in the design to the interim beachfill project…. We are pleased that we could work together to design a project to satisfy the needs of the National Park Service, while … working to minimize any potential adverse effect on surfing." ■

rebecca_beavers@nps.gov
Coastal Geologist, Geologic Resources Division, Lakewood, Colorado

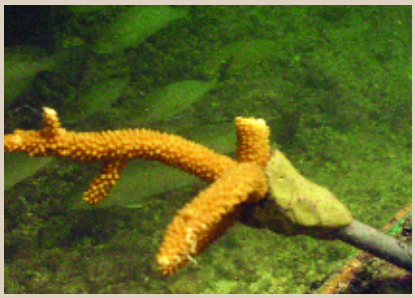
astein@surfrider.org
Geoscientist-in-the-Park, Surfrider Foundation USA, San Diego, California

JEFF FLINDT, *SURFING MAGAZINE*

Surfers enjoy a breaker at Assateague Island National Seashore, one of at least 25 units in the National Park System with significant surfing resources. An ongoing survey of surfing areas in the national parks is developing information for management of this recreational park resource.

Building a coral nursery at Biscayne National Park

by Richard Curry, Daniel DiResta, and Shay Viehman



NPS PHOTO BY V. CORNETT

With more than 20 boats running aground on coral reefs annually in Biscayne National Park, Florida, the National Park Service is challenged to protect the park's coral reefs. Add to that other disturbances such as coral disease, storms, and destructive fishing and the problem is multifaceted, requiring an integrated management strategy. Part of the solution lies in an innovative restoration program being pioneered at the park that focuses on rebuilding damaged coral reefs with coral grown in a nursery (photo, bottom). In 2002 the nursery was expanded greatly to provide material for future restoration projects.

NPS PHOTO BY SHAY VIEHMAN

The operational principles used in this hard-coral nursery are identical to those for conventional plant nurseries: manipulating environmental conditions to attain maximum growth, size, and survivability. The only difference is time; where plant nurseries cycle their product in one to four years, coral nurseries may require 10 times that.

Park scientists and volunteers populate the nursery by rescuing damaged coral fragments (photo, top) that would die if not transferred to a stable and secure location. The vessel groundings that occur on the coral reefs in the park provide more than enough material for the nursery; no additional collections are made from undamaged reefs. The park will increase its nursery stocks by dividing the damaged colonies brought in from the reef and by fragmenting those coral colonies that have reached a suitable size (>15 centimeters, or about 6 inches).

Unlike the few other hard-coral nurseries worldwide, the four nursery sites at Biscayne are located in well-protected areas, providing easy access for monitoring and maintenance. These sites also facilitate simple experiments focused on enhancing growth and regulating growth inhibitors such as algae. Volunteers from local schools and the public assist in research and implementation of optimal nursery maintenance techniques. Other partners are the University of Miami, the National Oceanic and Atmospheric Administration, and the University of North Carolina, which are developing techniques for capturing coral sperm and eggs during annual spawning and growing them into juvenile corals in order to further increase nursery stocks. Soon, nursery-grown corals will provide an environmentally sensitive option for use in coral reef restorations. ■

richard_curry@nps.gov
Science/Research Coordinator, Biscayne National Park, Florida

diresta@miami.edu
Associate Professor, University of Miami

shay_viehman@nps.gov
Associate Science/Research Coordinator, Biscayne National Park, Florida

Marine fisheries regulation in national parks

by Cliff McCreedy

The National Park Service manages 64 park units located on the coasts of the Atlantic and Pacific Oceans, the Gulf of Mexico, and the shores of the Great Lakes. Approximately 3 million acres of submerged lands and surrounding waters of these units protect different facets of our coastal heritage, including coral reefs, coastal bays, estuaries, kelp forests, and fjords.

Fisheries management in the national parks follows regulations and management policies founded in the NPS Organic Act of 1916, which directs the National Park Service to conserve these areas unimpaired for the enjoyment of future generations.

Leading role for NPS in Coral Reef Task Force

by Cliff McCreedy

Twenty-seven percent of coral reefs have been lost or seriously degraded worldwide and another 60% are threatened, according to the Global Coral Reef Monitoring Network and the World Resources Institute. Charged by Executive Order 13089 to protect the nation's imperiled coral reefs, a task force of 17 federal, state, and territorial agencies are coordinating their responses to threats from impaired water quality, overfishing, coral bleaching, and disease. As part of the Department of the Interior, the National Park Service is a key player in these efforts under the U.S. Coral Reef Task Force, cochaired by the Assistant Secretary for Fish and Wildlife and Parks, Harold Craig Manson. And with more than 275,000 acres of coral reefs, the 10 coral reef national park units not only offer outstanding recreational opportunities but also a chance to protect their biodiversity and astonishing natural beauty for future generations to enjoy. Assistant Secretary Manson said, "We need to develop an inventory of coral reef resources, conduct an assessment of the state of reefs, and monitor their health over the long term. We need to take action now to reduce pollutants and sedimentation on reefs" and "stop the overharvesting of coral reefs and the fish and animals that depend on them."

The NPS Water Resources Division is providing national policy and planning support to the task force and helping parks to meet the challenge from the assistant secretary. The National Park Service is pursuing cooperative programs with states, territories, and federal partners to manage and restore reef fish populations (see page 50) and to address sources of sedimentation and pollutants in coastal park watersheds. In 2001, Dry Tortugas National Park set aside the 46-square-mile (119-square-kilometer) research natural area as a no-take reserve to protect shallow seagrass beds, coral reefs, and mangrove communities. General management plan updates are under way to implement no-take reserves at the new Virgin Islands Coral Reef National Monument and at the expanded Buck Island Reef National Monument. ■

NPS PHOTO BY MATT PATTERSON

Mangrove prop roots, coral heads, and fish in the recently designated Virgin Islands Coral Reef National Monument.

cliff_mccreedy@nps.gov
Marine Management Specialist, Water Resources Division, Washington, D.C.

Current policies allow recreational fishing in parks consistent with state regulations and 36 *Code of Federal Regulations* part 2.3, except where specifically prohibited. However, commercial fishing is allowed only where authorized by law or treaty rights. Cooperative management and collaboration are critical to protect marine fisheries because NPS and state agencies frequently share jurisdiction over coastal resources. In some parks, statutory provisions control whether or not commercial fishing may occur and whether overall fisheries jurisdiction is held by the National Park Service, the states, or both concurrently. Although the National Park Service retains authority to implement regulations that are more restrictive than state regulations, joint planning is frequently the best approach to protecting biological integrity and the quality of recreational fishing in the national parks. ■

cliff_mccreedy@nps.gov
Marine Management Specialist, Water Resources Division, Washington, D.C.

AWARD-WINNER PROFILE

Bond's ability to see the big picture helps preserve Big Island park

NPS PHOTO

Stanley Bond (left) and a hula teacher play wooden drums made from dead milo trees harvested in Kaloko-Honokohau. The park allows hula groups to use dead wood that would otherwise be cut and chipped by the park as a way to fulfill their mission to perpetuate native Hawaiian traditions.

Dr. Stanley C. Bond is employed by the Kaloko-Honokohau National Historical Park in Hawaii, and he's good at his job. For Stan, it's the ability to see the "big picture" that distinguishes him. "I take a holistic look at the park; I understand how everything works together to interpret native Hawaii." And it's the challenge to keep all the parts working that motivates Stan to overcome all obstacles. His environmental leadership earned him the 2001 Trish Patterson Student Conservation Association Award for Natural Resource Management in a Small Park, presented in 2002. He did something no one else had ever done: he presented his concerns about the protection and preservation of the park's resources to the State of Hawaii Land Use Commission, and he prevailed.

In spring 2000 a plan to build an industrial park directly upslope from Kaloko-Honokohau required Stan's professional attention. He foresaw the negative impact that pollutants from the site could have on the park: two brackish water fishponds, almost 600 acres of marine and coral reef habitat, several threatened and endangered species, and other hydrobiological resources were in danger. The county did not have adequate sewage treatment, storm-water runoff control, or roadway infrastructure, and until it did, a project of this magnitude would be detrimental to the park. Because Stan's training is in archeology, he gathered helpers: a marine biologist and a brigade of experts in all forms of water sciences, a Department of the Interior solicitor, stakeholders, and community groups. Together they worked for strict conditions to be placed on the project to protect the park. After a two-year struggle, the Land Use Commission concurred with the recommendations of Stan and his crew.

Stan's foresight, motivation, and leadership set a new standard by which Hawaii and the rest of the United States will view their natural resources in the future. ■

Tribute to Dr. James R. Allen

by Mary Foley

On 30 July 2002, the National Park Service lost a valued treasure. While commuting to his office in Boston, USGS Coastal Geomorphologist Dr. James R. Allen suffered a heart attack and died. Jim was the National Park Service's key science advisor on major coastal erosion issues. He knew everything about coastal dynamics, and what he did not know he would strive to learn and understand. He was well respected and trusted.

Jim was passionate about the role of science in public policy decision making. The National Park Service does not need its scientists to serve as advocates for natural resource protection, he would argue; it needs good science to guide its decisions. He was a great teacher, patiently instructing park managers, interpreters, lawyers, legislators, and coastal scientists alike on the state of the knowledge and complexities of shoreline dynamics in our national parks. The National Park Service, the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, and countless other state and federal agencies have benefited from his sound counsel.

Jim leaves a legacy of accomplishments in the National Park System. He had recently completed a major scientific investigation on erosion processes at Fire

Inventory and mapping of coastal resources in Glacier Bay National Park

by Phoebe Vanselow

NPS PHOTO

In 1989 the *Exxon Valdez* oil spill highlighted the need for detailed baseline data on Alaskan coastal resources to help guide response and recovery efforts. Baseline information also helps managers detect change over time, both natural and human-related. In 2002, Glacier Bay National Park and Preserve completed its sixth field season of the Coastal Resources Inventory and Mapping Program. The program focuses on the development and implementation of an accurate, repeatable, and affordable inventory protocol that can be passed on for use on other coastlines in Alaska and beyond. To date, more than 880 miles of coastline in Glacier Bay National Park has been mapped, including all of Glacier Bay proper.

During low-tide "windows," teams of two scientists walk the coast, dividing the shoreline into segments based on changes in substrate and slope. For each segment a variety of physical and biological attributes are described and digital images are recorded. The precise boundaries of the segments are drawn on aerial photo enlargements of the coastline. After data processing, all of the information is accessed via an easy-to-use database that allows one to "walk the coast" and display for any segment its exact location, an aerial photo of that segment, ground photos showing what the beach actually looks like, and all coastal resource data associated with the segment.

In 2003, fieldwork using the current protocol will wind up. The more exposed, homogeneous shoreline of the outer coast of the park will likely be mapped using aerial videography. A public version of the database will be online in the next year or two, giving other researchers, oil spill responders, and the public easy access to the data with the ability to focus on what interests them most. Additional information is available at http://www.nps.gov/glba/learn/preserve/projects/coastal/index.htm. ■

phoebe_vanselow@nps.gov
Coastal Biotechnician, Glacier Bay National Park and Preserve, Alaska

Island National Seashore, New York, that will contribute greatly to the long-term preservation of the park. He was also instrumental in establishing the Boston Harbor Islands National Recreation Area in Massachusetts. He provided the detailed geological analysis that supported the finding that this system of islands was indeed nationally significant and should be included in the National Park System. He lent his expertise to the newly developing Vital Signs Monitoring Program through the design of a shoreline monitoring protocol for all the seashore parks in the Northeast Region. Jim's protocols will be used for decades to come.

Jim was dedicated to protecting the fragile coastal ecosystems of our national parks. He was also passionate about the accuracy of scientific information and its application to park management issues. These attributes will be difficult, if not impossible, to replace. Dr. James R. Allen will be sadly missed. ■

mary_foley@nps.gov
Chief Scientist, Northeast Region, Boston, Massachusetts

Jim Allen